Time-aware trust model for recommender systems

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Abstract

Trust is an imperative issue in any human society. It is built up with the survey of recurrent interactions between fellows. By consequence, trust is sensible to the time, which we call the temporal factor is trust relationship. During the last decade, the arise of social web resulted a serious need to a trust model for this virtual society. Many models were proposed to represent computational trust in different applications of social web. Even models that represent trust as incremental measurement, do not accord enough importance to the time axe. In this paper, we propose and compare many hypothesis to integrate the temporal factor in measuring trust between fellows.

I. Introduction

Social web connects users to each others over the planet. It allows them to cooperate and exchange information. Trust is the subjective feeling of a fellow (truster), that another fellow (trustee) has the capability and the willingness to assist him in accomplishing a task to the favour of the truster [1]. This feeling is supported by many knowledge sources like long term individual interactions between both users, a word of mouth assistance by friends, and the reputation of the trustee. These sources permit to the truster to predict the trustworthiness (the intentions and the capabilities) of the trustee [3].

Many trust models were proposed in many social web applications [7, 5, 2]. In sooner works [3], we presented and tested many trust models based on the subjective logic [4]. Trust relationships are represented by subjective logic opinions. A simple opinion in subjective logic is a probabilistic structure based on the multiple interactions between users. Subjective logic is not time sensitive, which means that all interactions have the same importance. We think that interactions is not perceived the same way over time. We believe that some interactions are more important than others when computing an opinion.

Suppose that Alex had to contact the client service of his internet provider six times this year. He was satisfied by the four sooner interaction, and unsatisfied by the later two. Suppose that Bob asks from Alex to advice him concerning the trustworthiness of client service. From subjective logic point of view, Alex still has more positive interactions than negative, which implies that his opinion tends to be positive. But if we consider the recency of the interactions, the opinion will be that the service was usually good, but it degraded recently, which might be more realistic.

II. Proposed models

I. Forgetting curve model

We use forgetting curve [6] to promote recent interactions. Which consider that forgetting is "fast first, slowly later". We apply a time window concept on the interactions between users, this concept is compatible with the forgetting curve law, and already tested in [8, 9] on a collaborative filtering based recommender system.

II. Expectancy-aware model

The second hypothesis that we shall test is related to both recency and the expectancy of the interaction. We suppose that people have tendency to be more affected by an interaction that they could not expect its result. In this model, we consider $b_{(A,B,t)}$ as the probability that a user A trusts a user B at the time t. if $b_{(A,B,t)} \geq 0.5$ then A expects that B is trustworthy, whereas $b_{(A,B,t)} < 0.5$ means that A thinks that B is untrustworthy. $b_{(A,B,t)}$ is given by the following formula:

$$b_{(A,B,t)} = b_{(A,B,t-1)} + \alpha \times (\delta - b_{(A,B,t-1)}) \quad (1)$$

Where $0 \leq \alpha \leq 1$, and δ is a binary variable: $\delta = 0$ for unexpected interactions values (ex. when A think that B is trustee before the interaction, and discover that he was wrong), $delta = 1$ when the result of the interaction agrees with the expected value.

We need to adjust this model in order to slightly modify $b_{A,B}$ for expected results, and more radically for unexpected results. This can be done by modifying the variable α.

III. Perspectives and future work

In this paper we present two prototypes about time-awareness in trust models. The proposed models need to be implemented and tested to be validated.

As we have already tested our trust models on the dataset stackExchange[1], we think that we can test our time-aware models on the same dataset, which will allow us to compare the models and measure the performance improvement brought up by the time-awareness.

[1] http://www.stackexchange.com

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